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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/671,810	09/26/2003	Hsueh Sung Tung	H0005034	6883

7590 06/24/2005

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EXAMINER
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WITHERSPOON, SIKARL A

ART UNIT	PAPER NUMBER
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1621

DATE MAILED: 06/24/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/671,810

Applicant(s)

TUNG ET AL.

Examiner

Sikarl A. Witherspoon

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 19 April 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-4, 6-42 and 44-75 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-4, 6-42, 44-68, 70 and 72-75 is/are rejected.
- 7) ☒ Claim(s) 69 and 71 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>5/31/05</u> | 6) <input type="checkbox"/> Other: _____  |

### DETAILED ACTION

The examiner has considered applicants' amendment filed April 19, 2005 and the remarks/arguments therein. In light of said amendment, the examiner has withdrawn the rejections of record; however, applicants' amendment has necessitated the following new rejections.

#### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-4 and 6-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Henne et al (J. Amer. Chem. Soc. 1946) and Mallikarjuna et al (US 6,031,141) in combination, and further in view of Merkel et al (US 6,274,779), Nappa et al (US 5,414,165) and Tung et al (US 5,902,912).

The instant claims are drawn to a process for preparing 1, 1, 3, 3, 3-pentafluoropropene by reacting a reactant comprising 1,1,1,3,3,3-hexafluoropropane, and optionally additionally 1-chloro-1,1,3,3,3-pentafluoropropane with a caustic under conditions sufficient to dehydrofluorinate said hexafluoropropane and optionally additionally dehydrochlorinate said 1-chloro-pentafluoropropane to form said pentafluoropropene.

Henne et al teach a process for making pentafluoropropene wherein 1-chloro-1,1,3,3,3-pentafluoropropane is reacted with alcoholic potassium hydroxide to produce said pentafluoropropene (col. 2, second paragraph). The reference is silent with regard to reaction temperature and pressure, and as such, it has been presumed that the reaction is conducted at standard temperature and pressure.

The differences between Henne et al and the instant invention are that Henne et al do not teach pentafluoropropane as an additional reactant with 1-chloro-1,1,3,3,3-pentafluoropropane, do not teach purification of the pentafluoropropene produced by the process, do not teach the specific range of caustic concentration employed in the process, and do not teach the method by which the starting material(s) is/are prepared, as claimed herein.

With regard to the first difference, Henne et al does not teach 1,1,1,3,3,3-hexafluoropropane as a reactant; however, Mallikarjuna et al teach a process for preparing pentafluoropropene by dehydrofluorination of 1,1,1,3,3,3-hexafluoropropane, albeit with different reagents. The examiner therefore takes the position that it would have been obvious to a person of ordinary skill in the art, in light of the combined reference teachings, to combine two known precursors for a given compound, in the present case, 1,1,3,3,3-pentafluoropropene, using a well known reaction for making said compound, i.e., dehydrofluorination. One of ordinary skill would have been motivated to combine two such reactants by the desire to prepare an optimal amount of a compound that is known to be useful in the preparation of fluorocarbon polymers that are recognized to have excellent weathering and chemical resistance properties.

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With regard to the next difference, as stated above, Henne et al do not teach the purification of the pentafluoropropene product; however, Merkel et al teach a process for purifying hexafluoropropane wherein said product is washed with a caustic solution, followed by drying, i.e., with calcium sulfate or molecular sieves, and subsequent distilling (abstract and col. 2, line 15 to col. 4, line 62).

Although Merkel et al teach the purification of a different product, i.e., a fluoropropane, instead of a fluoropropene, the examiner, nonetheless, takes the position it would have been obvious to a person of ordinary to employ the purification process taught by Merkel et al in the dehydrofluorination process taught by Henne et al. A person of ordinary skill would have recognized that the purification steps taught by Merkel et al would be effective for purifying halohydrocarbons in general, absent a showing to the contrary, and therefore would have been motivated to employ the purification process taught by Merkel et al by the desire to purify the halohydrocarbon, i.e. pentafluoropropene obtained by the dehydrofluorination process taught by Henne et al.

With regard to the last differences, neither Henne et al nor Merkel et al teach the specific range of caustic concentration recited by instant claim 11, nor do the references teach the method by which the dehydrohalogenation reactants were prepared.

First, the examiner purports that while Henne et al is silent with regard to the concentration of the caustic material, it would have been obvious to a person of ordinary skill in the art to conduct the dehydrofluorination reaction employing *any* concentration of caustic solution that would have afforded an optimal conversion of the reactant to the

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fluoropropene product, absent a showing of unexpected results by applicants when employing a caustic concentration in the range recited in the instant claims.

Finally, Henne et al do not teach the method by which the reactants are prepared; however, Nappa et al teach a process for preparing hexafluoropropane, as well as its haloprecursors, including 1-chloro-1,1,3,3,3-pentafluoropropane, by reacting hexachloropropane with hydrogen fluoride in the vapor phase, at a temperature from 200 to about 400° C, in the presence of a trivalent chromium catalyst (abstract). The molar ratio of hydrogen fluoride to pentachloropropane is in the range of 1 to 1 to 100 to 1, and the pressure is not critical (col. 3, line 40 to col. 4, line 6).

Tung et al teach a similar process to that of Nappa et al for preparing hydrofluorocarbons such as hexafluoropropane wherein the reaction is conducted in the liquid phase, and fluorination catalysts comprising halides of antimony, tantalum, molybdenum, tin, and niobium, may be employed, and the catalyst may be regenerated by adding chlorine, and at a reaction temperature of 30 to 200° C (col. 4, line 37 to col. 5, line 39).

It therefore would have been obvious to a person of ordinary skill in the art to combine the fluorination processes taught by Nappa et al, and Tung et al, wherein it is taught that fluorination catalysts other than trivalent chromium may be employed and that a liquid phase fluorination process can be employed, with the dehydrofluorination process taught by Henne et al. A person of ordinary skill would have been motivated to combine such teachings by the desire to prepare the halopropane precursor(s) that

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would be dehydrohalogenated to produce the desired fluoropropene in the process taught by Henne et al.

Claim 70 is rejected under 35 U.S.C. 103(a) as being unpatentable over Henne et al as applied to claims 1-4 and 6-31 above, and further in view of Aoyama et al (US 5,679,875).

The instant claim limits the process of claim 1 to the use of an aqueous caustic solution. Henne et al only teach the use of an alcoholic potassium hydroxide solution; however, Aoyama et al teach that is well known, i.e., "conventional" to employ an aqueous potassium hydroxide solution in making pentafluoropropene, albeit from a different starting material.

The examiner purports that the combined reference teaching suggests the equivalence of using alcoholic or aqueous solutions of potassium hydroxide, depending on reacting conditions, in such processes, and as such, the instant claim is rendered obvious.

Claims 32-42, 44-68, 72, 74 and 75 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mallikarjuna et al, and further in view of Nappa et al and Tung et al.

The instant claims are drawn to a process for making 1,1,3,3,3-pentafluoropropene by thermally decomposing a reactant comprising at least one of 1-chloro-1,1,3,3,3-pentafluoropropane and 1,1,1,3,3,3-hexafluoropropane, under conditions sufficient to dehydrochlorinate said 1-chloro-1,1,3,3,3-pentafluoropropane,

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and/or to dehydrofluorinate said 1,1,1,3,3,3-hexafluoropropane, wherein the decomposing is conducted with or without a catalyst, selected from supported transition metal halides, supported transition metal oxides, bulk transition metal oxides, and combinations thereof. Further limitations include the catalyst being an iron, nickel, or cobalt halide, and, the reactants of the dehydrofluorination reaction being 1-chloro-1,1,3,3,3-pentafluoropropane and 1,1,1,3,3,3-hexafluoropropane, and are prepared by fluorination hexachloropropane with hydrogen fluoride in the presence of a fluorination catalyst, in the vapor and liquid phases.

Mallikarjuna et al teach a process wherein hexafluoropropane (HFC-236fa) is dehydrofluorinated by reacting said compound at a temperature of 300 to 400° C in the presence of a trivalent chromium fluoride catalyst that may be supported or unsupported to form 1,1,3,3,3-pentafluoropropene (col. 6, lines 35-55).

The differences between Mallikarjuna et al and the present claims are that Mallikarjuna et al only teach a trivalent chromium catalyst that may be supported or unsupported, and does not teach the method by which *both* of the reactants of the instant dehydrohalogenation process are prepared.

With regard to the first difference, the examiner purports that the trivalent chromium catalyst taught by Mallikarjuna et al renders the iron, nickel, or cobalt halide catalyst of the present claims obvious, since all of the catalysts mentioned are transition metal-based catalysts. To that end, the examiner takes the position that absent a showing of unexpected results, by applicants, when employing the transition metals specifically recited in the present invention, it would have been obvious to a person of



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ordinary skill in the art to employ any transition metal halide catalyst in the process taught by Mallikarjuna et al, since one of ordinary skill would reasonably expect that a transition metal other than trivalent chromium would effectively catalyze the thermal decomposition of the halohydrocarbon reactant.

As stated above, Mallikarjuna et al do not teach the method by which both of the reactants are prepared; however, the reference does teach at column 3, lines 3-7, that hexafluoropropane can be prepared by contacting hydrogen fluoride and hexachloropropane in the vapor phase, in the presence of a trivalent chromium catalyst, as per US 4,414,165 to Nappa et al. Furthermore, Nappa et al teach a process for preparing hexafluoropropane, as well as its haloprecursors, including 1-chloro-1,1,3,3,3-pentafluoropropane, by reacting hexachloropropane with hydrogen fluoride in the vapor phase, at a temperature from 200 to about 400° C, in the presence of a trivalent chromium catalyst (abstract). The molar ratio of hydrogen fluoride to pentachloropropane is in the range of 1 to 1 to 100 to 1, and the pressure is not critical (col. 3, line 40 to col. 4, line 6).

Tung et al teach a similar process to that of Nappa et al for preparing hydrofluorocarbons such as hexafluoropropane wherein the reaction is conducted in the liquid phase, and fluorination catalysts comprising halides of antimony, tantalum, molybdenum, tin, and niobium, may be employed, and the catalyst may be regenerated by adding chlorine, and at a reaction temperature of 30 to 200° C (col. 4, line 37 to col. 5, line 39).

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It therefore would have been obvious to a person of ordinary skill in the art to combine the fluorination process taught by Nappa et al, and Tung et al, wherein it is taught that fluorination catalysts other than trivalent chromium may be employed and that a liquid phase fluorination process can be employed, with the dehydrofluorination process taught by Mallikarjuna et al. A person of ordinary skill would have been motivated to combine such teachings by the desire to prepare the halopropane precursor(s) that would be dehydrohalogenated to produce the desired fluoropropene in the process taught by Mallikarjuna et al.

It would have been rendered further obvious that both 1-chloro-1,1,3,3,3-pentafluoropropane and 1,1,1,3,3,3-hexafluoropropane could be dehydrohalogenated simultaneously to product the target fluoropropene, i.e., 1,1,3,3,3-pentafluoropropene, in the process taught by Mallikarjuna et al, since Nappa et al teach that 1-chloro-1,1,3,3,3-pentafluoropropane and 1,1,1,3,3,3-hexafluoropropane are co-products produced in the fluorination of hexachloropropane, and as such, it would have been reasonable to expect that the starting material, i.e., halopropane in the process of Mallikarjuna et al would comprise a mixture of the two previously mentioned halopropanes, if said mixture was prepared by the fluorination process taught by Nappa et al.

Claim 73 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mallikarjuna et al as applied to claims 32-42, 44-68, 72, 74 and 75 above, and further in view of Nappa et al (US 6,369,284).

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The instant claim limits the process to the decomposing being conducted with a catalyst selected from supported transition metal oxides, bulk transition metal oxides, and combinations thereof.

Mallikarjuna et al do not teach metal oxide catalysts; however, Nappa et al teach a process for the manufacture of pentafluoropropenes using as catalyst oxides, fluorides or oxyfluorides of magnesium and zinc (zinc being a transition metal).

The examiner purports that the combined reference teaching suggests the equivalence of transition metal halides (taught by Mallikarjuna et al) and transition metal oxides (taught by Nappa et al) in such process for making pentafluoropropenes. Therefore, it would have been obvious to a person of ordinary skill in the art, in view of the reference teachings to employ a transition metal oxide or transition metal halide, with the reasonable expectation of effecting a dehydrofluorination reaction.

Claims 69 and 71 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Applicant's arguments with respect to claims 1-68 have been considered but are moot in view of the new ground(s) of rejection.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

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§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

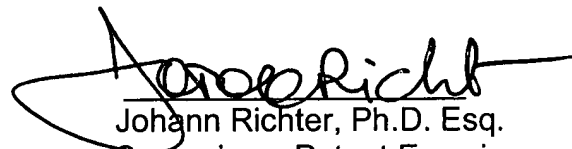
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sikarl A. Witherspoon whose telephone number is 571-272-0649. The examiner can normally be reached on M-F 8:30-6:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Johann Richter can be reached on 571-272-0646. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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